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ABSTRACT

An Audio-Tutorial (A-T) mathematics program was developed at Springfield Technical Community College to meet the needs of students with different levels of mathematical competency and to develop the math proficiency needed in high technology areas. The A-T program offers 15 credits of mathematics at the pre-calculus level. The main features of the A-T program are: (1) a mathematics placement test places entering students in A-T remedial or college-level courses or in traditional lecture sections; (2) learning is self-paced; (3) the emphasis is on self-learning aided by texts, audio tapes, and in-class one-to-one instruction; (4) a testing center can be used by students on a walk-in basis; (5) a staff of clerical workers and student tutors provides aid to students; (6) grading is non-punitive; and (7) tests are scored immediately. After discussing the different components of the A-T program (i.e., the placement examination, the use of a Student Information Booklet to explain math requirements and offerings, the A-T classroom environment, the testing and correction centers, the tutorial area, and the grading system), this descriptive report outlines the advantages of the program and a number of possible directions for the future, including the utilization of the campus computer, and the grouping of arithmetic students into homogeneous classes of 20 to 25. The paper concludes with comments on the benefits and cost-effectiveness of the program. (HB)

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REMEDIAL AND DEVELOPMENTAL MATHEMATICS AT SPRINGFIELD TECHNICAL COMMUNITY COLLEGE'S MATHEMATICS CENTER

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REMEDIAL AND DEVELOPMENTAL MATHEMATICS AT SPRINGFIELD TECHNICAL COMMUNITY COLLEGE'S MATHEMATICS CENTER

Springfield Technical Community College (STCC) has a large base of industries and businesses looking for college-educated high technology and business workers. Because STCC is serving the needs of students and the community, it was necessary to develop a mathematics program capable of working with students at each level of mathematical competency and providing many of them with a course of study which could give them the proficiency needed in high technology areas. The audio-tutorial (a-t) program is designed to fill this need. It offers 15 credits of mathematics at the pre-calculus level. The first 9 credits carry college credit, but not graduation credit. It is these 9 credits, which include basic arithmetic, elementary algebra I and elementary algebra II, that constitute our remedial/developmental program in mathematics.

Each student planning to attend STCC must take the mathematics placement test. The results indicate the level at which we believe the student is best able to work. Some

students go into college-level courses in the a-t program or traditional lecture sections. The rest are placed in our remedial/ developmental courses.

The hallmarks of the a-t program are these: students set their own pace for learning; the setting is self-learning by students aided by well-written texts, audio tapes and an in-class faculty member; a testing center open 57 hours per week for all students on a walk-in basis; a dedicated staff of clerical workers and student tutors; a non-punitive grading system; test scoring within 1 minute of completing an exam; cost-effectiveness without the use of computers. Let's take a look at each of the main areas in greater detail.

The Placement Examination In Mathematics

The mathematics faculty designed a 75-question multiple-choice placement examination. The questions are arranged in blocks of 15, which correspond to each of the 5 a-t levels offered. Students take this examination on a walk-in basis whenever the math center is open. This includes evenings and summers as well as the days of the academic year. Most students take this exam before the beginning of their freshman semester. It is safe to assume most students complete the examination within 1 to 1½ hours. Students are given a set of questions, work paper, an electronic scoring pencil and a standardized answer form compatible with our mark-sense reader. Upon completing the exam, the student returns

the questions and goes into the adjacent room, the correction center, where the test is scored immediately and the student receives a math placement.

Wrong answers are marked in red on the answer form. A clerk scans each of the 5 blocks of 15 questions. A student who scores 8 or more correct answers on a section is automatically eligible for the next higher placement. When a student scores less than 50% correct on 2 consecutive sections, placement is made at the level where the first failure occurs.

Because student performance varies, any student can discuss placement with an advisor and a member of the mathematics faculty. Previous school performance, SAT scores or previous work experience can result in overriding the placement test.

The actual placement depends upon each student's course of study. A placement card is issued to each student along with a copy of the Student Information Booklet.

The Student Information Booklet

The Student Information Booklet details the math requirements of each department on campus, the textbooks used in the a-t classes, a listing of all math courses and prerequisites, and the policies and procedures for using the testing center.

For registration purposes, all a-t classes are given one umbrella number, MM 100. This number covers all 15 credits

in a-t math courses.

The Audio-Tutorial Classroom

During the first week of classes, hourly orientations to a-t classes are conducted. During each time period, students select their instructors and new students are assigned to classes in a random manner. Most morning classes consist of 4 or 5 sections of 38 students each. Each student has either a programmed text or a traditional text written in a straightforward style. Students read these texts with little or no help from the faculty.

To aid students we have a file of audio-tapes in the correction center so that students can come into the classroom and listen to an audio-tape as they read their text material. It is interesting to note that poor readers, students for whom English is a second language, or very good math students use the tapes. The good math students use the tapes to slow themselves down, decreasing their errors and increasing their awareness of details. Any student who wants copies of tapes leaves a blank cassette with us and we tape the requested lecture(s). There is no fee for this service.

Each classroom has students at all 15 levels of work. This mix does not pose any hardship for the faculty. As a student reaches an area of the text where a problem or concept is difficult to understand he needs only go to the classroom instructor to discuss his area of concern. This means only

experienced faculty are really effective. They need to be able to change orientation and work on any problem and perceive the root of student difficulties.

When a student has taken an examination and wants to discuss all or part of it, the student waits for the exam to be returned to the instructor so that he can discuss it on a one-to-one basis. Faculty encourage students to review their test papers before discussing them in hopes that students find their own errors. Whenever student work is done correctly and scored as an incorrect answer, faculty change the grade, review the original test questions and the master answer sheet. When errors occur on the test or the answer sheet, the findings are verified and then changes are made.

The Testing Center

A testing center with a seating capacity of 100 contains a proctor and the files for all tests used in a-t courses. Each chapter test has 6 forms of a 10-question multiple-choice test. Each module (credit) of work has at least 6 forms of a 20-question multiple-choice exam. When a student comes into the testing center with a test-authorization form, a test is drawn from the front of the file (each file has test forms in random order). The student takes an answer form, a scoring pencil and a blank paper for working the problems.

Students are allowed to use calculators except in arithmetic tests and areas where they are expected to use tables and

interpolate or extrapolate data. All these tests are printed on colored paper.

After working the problems, the student returns the set of test questions. The proctor stamps the test-authorization form with the date, thereby verifying the return of the exam questions.

The Correction Center

After returning the test questions the student walks into the adjacent room where a clerk programs the test corrector from the master answer files and scores the student's answers. Incorrect answers are marked in red and the total number of correct answers are marked on the student work sheet and the answer form is filed and subsequently discarded.

The student is given a new test-authorization slip if he has received a grade of 70 or better. Any student, whether receiving a passing or failing grade, can go into the tutors' room nearby and review his work with a student tutor.

The Tutorial Area

Students who have completed the a-t math program or some traditional math course at a higher level and display the attributes of a good teacher are recruited as tutors by the math faculty. They are paid through the Tutorial Assistance Program or through state funds for disadvantaged students.

Every tutor is given material and a general orientation with the department chairman and the classified staff member who has

the responsibility of keeping records of student hours and answering any routine questions. Technical questions about mathematics are answered by faculty.

The rapport between tutors and students is excellent. The students find it easier to discuss areas of difficulty with tutors, especially during the first semester of their freshman year.

The tutorial area has bookcases stocked with mathematics books sent to the department by publishers for review. After the books have been reviewed, they are placed here so that tutors can use them as personal reference or for use with students needing tutorial assistance. Students and tutors are encouraged to keep any books which they find very helpful. All publisher's representatives have been enthusiastic about this use of review copies. The only restrictions for students is that they not sell any book which they take from the tutorial area. We exclude from the shelves any instructor's manuals and test booklets.

The tutorial area also has calculators and single copies of current a-t texts which are restricted to room use.

The Grading System

All chapter tests in a module of work are averaged and constitute 50% of that credit. The other 50% comes from the modular exam. Because we do not enter any grades below 70, no student receives

a grade below C⁻. Every attempt at a chapter test or modular exam is noted on our visible file cards with a slash in the corner of the appropriate box. A student passing an exam on the first attempt may retake the exam a second time. The higher of the two grades is entered as his grade for that chapter. A student who fails the first test has the same opportunity for a second retest. Any student failing the first two attempts continues to retest until the exam is passed. In this case, the clerks enter a score of 70 regardless of the actual test score.

During the middle of each semester, the clerical staff scan the visible file cards and identify those students who have completed 3 or more credits. Letters of commendation from the chairman of the mathematics department are typed and mailed to these students. A listing of all commended students from the day school and the division of continuing education is submitted to college and local newspapers and a brief article is published.

The Impact of the Program

Through the a-t program we are able to respond to student needs by giving them self-paced instruction that removes the fear of needing to pass 3 credits of mathematics in a single semester. Students who work slowly complete only those credits with which they are comfortable. Any partially completed credits are carried over into the next semester and students resume their study of

mathematics where they left off. It is not unusual for students to study during the intersession or the summer and begin the next semester by challenging a module exam. If they pass this exam, it counts as 100% of that credit.

All credits for a-t mathematics courses are reported on transcripts as one-credit courses.

One of the finer features of our a-t math program is its ability to respond to students for as little or as much mathematics as they need. A student who needs only one credit registers for his math course, earns his credit and stops coming to class. Other students not taking a math course can add an a-t math course at any time during the semester on a seats-available basis. We use a missing-student form to add these students to a class list and indicate the credits earned at the end of the semester.

Future Trends and Directions

Although we have a system which works well, there are certain options we would like to try.

One. Include a series of noon-time lectures, when there are no classes scheduled, as supplements to the regular a-t classes. There is a group of students who feel more comfortable if they supplement the self-paced a-t classes with a lecture series given at a 3-credit pace. Implementation of this option depends upon availability of funds, faculty and student interest.

Two. Utilize the computer on campus for grades, test correction and test generation. We already have one test corrector which can interface with our computer. If we modified the forms we use in the test center, we could discard our visible file cards and have all student records placed in the computer. This would mean quicker reporting of grades and less clerical work. With a computer terminal and a high speed printer, we could randomly generate tests so that each student would receive a personal exam which could be written upon, scored and kept by the student for tutoring or review.

Three. With an adequate number of faculty, we would like to incorporate lectures and other modes of instruction for our a-t students so that we could respond to various learning styles.

Four. We would like to experiment by grouping our arithmetic students into homogeneous classes of 20-25 students. New techniques of instruction and more time per student could be very helpful.

Conclusion

The flexible a-t system is a humanistic, responsive approach to students in our developmental/remedial courses. In addition to responding to the human needs of our students, it is also cost effective. We have approximately 40 sections of a-t math in operation each semester. Because the classes are heterogeneous, each class is full. Students at the higher levels are very autonomous, seldom needing faculty assistance. This

leaves more time for other students. The testing center is open to all students 57 hours each week. This makes student testing very efficient because students can take tests at any time when they are free, including evenings. It also permits the math center to be the college placement testing center on a walk-in basis.

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